1. A method for fabricating CPP GMR sensors of the synthetic spin valve type comprising:

providing a substrate;

forming on said substrate a GMR sensor stack of the synthetic spin valve type;

forming on said GMR sensor stack a conducting non-magnetic spacer layer;

forming on said spacer layer a capped ferromagnetic free layer, said free layer comprising a ferromagnetic layer on which is formed a conducting, non-magnetic capping layer;

patterning said spacer layer and capped ferromagnetic free layer and forming an insulating layer over said spacer layer, while using a single mask, self-aligned first and second lift-off process, said mask being formed by an electron-beam lithographic process employing primary and backscattered electron absorption.

2. The method of claim 1 wherein said single mask is formed by a process comprising:

forming a photoresistive double layer on said capped ferromagnetic layer, said double layer comprising a lower layer and an upper layer formed on said lower layer, wherein said upper layer is formed of a material that, upon electron absorption and subsequent heat treatment, is hardened and thereby made resistant to dissolution by a developing solution;

forming, by electron-beam lithography and subsequent heat treatment, a mask in a central portion of said resistive double layer, said mask comprising a first region of said

upper layer which has been hardened by the direct absorption of electrons from said electron beam, a second region which surrounds the first region and which has been partially hardened by the absorption only of electrons backscattered from said capped ferromagnetic region and a third region, which has been hardened by the direct absorption of electrons from said electron beam and surrounds both said first and second mask regions;

developing and completely removing all of said resistive double layer which is external to said third region and which has absorbed no electrons, said removal exposing a corresponding region of the capped ferromagnetic layer and said developing partially removing said second upper layer region, said second region having absorbed the lesser, backscattered portion of said electron beam and being only partially hardened thereby.

3. The method of claim 2 wherein said resistive double layer comprises a lower layer of PMGI photoresistive material formed to a thickness between approximately 30 and 200 nm, upon which is formed an upper layer of negative tone photoresistive material.

4. The method of claim 3 wherein the negative tone photoresistive material is commercially obtainable NEB22 photoresist, formed to a thickness of between approximately 100 and 300 nm.

5. The method of claim 2 wherein the first region of said mask is a two-dimensional region having a substantially square perimeter each of whose sides is of length between approximately 0.05 to 0.15 microns.

6. The method of claim 5 wherein the second region of said mask is a region of uniform width surrounding said first region, said second region having inner and outer perimeters which are substantially square, wherein said inner perimeter is contiguous with the perimeter of said first region and wherein said outer perimeter has sides of length between approximately 0.05 and 0.2 microns.

7. The method of claim 6 wherein the third region of said mask is a region of uniform width surrounding said second region, said third region having inner and outer perimeters which are substantially square, wherein said inner perimeter is contiguous with the outer perimeter of said second region and wherein said outer perimeter has sides of length between approximately 0.05 and 0.2 microns.

8. The method of claim 2 wherein said double lift-off process comprises:

removing, using a first etching process, said exposed region of the capped ferromagnetic layer and a corresponding portion of the spacer layer beneath it, the remaining portion of the spacer layer now being properly patterned;

lifting off said second and third regions of the resistive double layer using a second etching and dissolution process of said second mask region and exposing, thereby, a portion of said capped ferromagnetic layer beneath said second and third mask regions;

removing said exposed portion of the capped ferromagnetic layer by continued use of said second etching process and with the first region of the upper resist layer providing self-alignment, the remaining portion of said capped ferromagnetic layer now being correctly patterned;

forming an insulating layer over said spacer layer, said insulating layer abutting said capped ferromagnetic layer;

lifting off the first region of said double resistive layer, exposing, thereby, the correctly patterned capped free layer.

9. The method of claim 8 wherein said first etching process is an ion-beam etch (IBE) or a reactive ion etch (RIE).

10. The method of claim 8 wherein said second etching and dissolution process comprises an ion-beam etch (IBE) or a reactive ion etch (RIE) to remove said second upper layer region and expose said lower layer region, followed by the application of developer to at least partially dissolve the portions of said lower layer region exposed by the removal of said upper layer region and facilitate removal of said third and first regions of the upper resist layer.

11. The method of claim 8 wherein the first region of said double resistive layer is lifted off by dissolution of the layer beneath it using the solvent N-methyl-2-pyrrolidone.

12. The method of claim 1 wherein said GMR sensor stack comprises:

a seed layer;

a pinning layer formed of an antiferromagnetic material formed on said seed layer;

a synthetic antiferromagnetic pinned layer formed on said pinning layer, said pinned layer further comprising:

a first ferromagnetic layer;

an antiferromagnetically coupling layer;

a second ferromagnetic layer; and

the magnetizations of said first and second ferromagnetic layers being antiparallel.

13. The method of claim 1 wherein the spacer layer is a layer of Cu formed to a thickness between approximately 15 and 60 angstroms.

14. The method of claim 1 wherein the ferromagnetic free layer is a layer of CoFe formed to a thickness between approximately 10 and 80 angstroms.

15. The method of claim 1 wherein the capping layer is a layer of Cu formed to a thickness between approximately 10 and 300 angstroms.

16. An electron-beam lithographic process enabling the use of both primary and backscattered electrons to transfer patterns to photoresistive coatings comprising:

providing a substrate coated with a resistive double layer, said resistive double layer comprising a lower layer and an upper layer formed on said lower layer;

placing on said coated substrate a multiregion mask including concentric regions that are alternatively transparent to and opaque to the passage of an electron beam;

passing an electron beam through said mask, a primary portion of said beam passing through said transparent mask regions and being absorbed in regions of said upper layer directly beneath said transparent mask regions and a secondary portion of said electron beam being backscattered from said substrate and being absorbed in regions of said upper layer beneath said opaque mask regions;

developing said resistive double layer.

17. The method of claim 16 wherein said resistive double layer comprises a layer of photoresistive material which is soluble in developing solution, on which is formed a layer of photoresistive that is made increasingly insoluble to said developing solution by the absorption of increasing amounts of electrons and subsequent processing.

18. The method of claim 17 wherein said soluble photoresistive material is PMGI resist and said photoresistive material which can be made increasingly insoluble is a negative tone resist.

19. The method of claim 16 wherein said patterned resistive double layer is removed in a succession of lift-off processes enabling the substrate beneath said double layer to be patterned.

20. A CPP GMR sensor of the synthetic spin valve type comprising:

a substrate;

a GMR sensor stack of the synthetic spin valve type formed on said substrate;

a patterned conducting non-magnetic spacer layer formed on said GMR sensor stack;

a patterned capped ferromagnetic free layer formed centrally on said patterned spacer layer, said free layer comprising a ferromagnetic layer on which is formed a conducting, non-magnetic capping layer;

an insulating layer formed on said spacer layer and abutting said free layer; and

said spacer layer and capped ferromagnetic free layer being patterned and aligned using a single mask electron-beam lithographic process employing primary and backscattered electron absorption and a self-aligned first and second lift-off process; and

the patterning and alignment provided by said single mask electron-beam lithographic process producing a CPP GMR configuration having low resistance and increased sensitivity.

21. The sensor of claim 20 wherein the patterned capped free layer has a substantially square horizontal cross-section with a first side length and said capped free layer is positioned centrally on a spacer layer having a substantially square horizontal cross-

section with a second side length which is greater than said first side length and said spacer layer is positioned centrally on an upper surface of a GMR sensor stack having a substantially square horizontal cross-section which is vertically uniform and with a third side length that is greater than said second side length.

22. The sensor of claim 21 wherein the first side length is between approximately 0.05 and 0.15 microns, the second side length is between approximately 0.05 and 0.2 microns and the third side length is greater than approximately 0.2 microns.